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(54) MONITORING DEVICE, COOKER AND MONITORING METHOD

(57) The present invention provides a monitoring device (106) for monitoring liquid overflow in a cooking vessel on a cooking hob (102, 103, 104, 105) of a cooker (100), the monitoring device (106) comprising a distance sensor (107) that is arranged over the cooking hob (102, 103, 104, 105) and that is configured to measure a content distance between the distance sensor (107) and a content of the cooking vessel, and a control unit (109) that is coupled to the distance sensor (107) and that is configured to compare the measured content distance to a threshold distance (110) and to output a warning signal (111) if the measured content distance is smaller than the threshold distance (110). Further, the present invention provides a cooker (100) and a respective monitoring method.

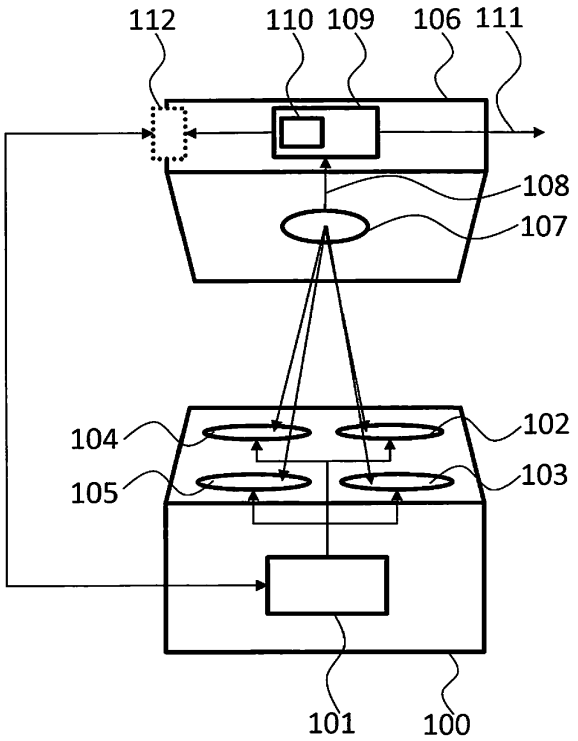

Fig. 1

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Description

TECHNICAL FIELD

[0001] The invention relates to a monitoring device, a cooker and a monitoring method.

BACKGROUND

[0002] Although applicable to any heating device, the present invention will mainly be described in conjunction with kitchen cookers.

[0003] When cooking, especially with liquids, the liquids may start boiling. When a liquid like water is boiling, the level of liquid in the respective cooking vessel may rise. If the heat transfer to the cooking vessel is not interrupted or reduced, the liquid will eventually overflow and spill over the cooking surface.

[0004] Accordingly, there is a need for detecting a raising level of content in a cooking device.

SUMMARY OF THE INVENTION

[0005] The present invention provides a monitoring device with the features of claim 1, a cooker with the features of claim 11 and a monitoring method with the features of claim 13.

[0006] Accordingly, it is provided:

> A monitoring device for monitoring liquid overflow in a cooking vessel on a cooking hob of a cooker, the monitoring device comprising a distance sensor that is arranged over the cooking hob and that is configured to measure a content distance between the distance sensor and a content of the cooking vessel, and a control unit that is coupled to the distance sensor and that is configured to compare the measured content distance to a threshold distance and to output a warning signal if the measured content distance is smaller than the threshold distance.

[0007] Further, it is provided:

> A cooker for cooking content in cooking vessels, the cooker comprising a number of cooking hobs for accommodating the cooking vessels, and a monitoring device according to the present invention.

[0008] Further, it is provided:

> A monitoring method for monitoring liquid overflow in a cooking vessel on a cooking hob of a cooker, the monitoring method comprising measuring a content distance between a distance sensor and a content of the cooking vessel with an ultrasonic distance sensor or with an optical distance sensor, comparing the measured content distance to a threshold distance, and outputting a warning signal if the measured content distance is smaller than the threshold distance.

[0009] The present invention is based on the fact that the level of liquid inside of a cooking vessel will increase when the liquid starts boiling. When the liquid overflows from the cooking vessel, the cooking surface may become dirty. In addition, it is difficult to clean dry stains after cooking. Therefore, the present invention identifies overflow situations and takes respective precautions.

[0010] The present invention therefore tries to detect an overflow of liquid inside of a cooking vessel by sensing the instant liquid level. The present invention provides the distance sensor that continuously measures the level of liquid in the cooking vessel. To this end the distance sensor is arranged over the cooking surface of the cooker, e.g. over a cooking hob that accommodates the cooking vessel and senses the downward distance between the distance sensor and the content of the cooking vessel, i.e. the content distance.

[0011] The distance sensor is coupled to a control unit and provides data representing the measured content distance to the control unit. The data may e.g. be provided as analog voltage or current or as digital data. The control unit will then evaluate the measured content distance and determine an increase in the level of content in the cooking vessel. The control unit may e.g. measure the content distance in predetermined time intervals, once every second or once every 500 milliseconds or once every 2 seconds.

[0012] If the level of content in the cooking vessel rises such that the measured content distance falls below the threshold distance, the control unit emits a warning signal. This warning signal may then e.g. be provided as acoustic warning to a user.

[0013] In addition or as alternative the warning signal may also be provided to a controller of the cooker. The controller

of the cooker may then e.g. reduce the power of the respective cooking hob. It is understood that the cooker may e.g. be an electric cooker like e.g. an induction cooker or a resistive cooker. It is however understood, that the cooker may be any type of cooker that allows controlled the output power of the single cooking hobs. The cooker may therefore e. g. be a gas cooker with controllable gas valves.

[0014] The control unit may be any type of control unit that is capable of comparing the measured content distance to the threshold distance. In case that a fixed threshold distance is used, the control unit may be as simple as an analog comparator, wherein one of the comparator inputs may be coupled to a constant voltage source that defines the threshold distance. The other comparator input may be coupled to the output of the distance sensor, in this case an analog distance sensor. However, the control unit may e.g. also be a processor based control unit, like e.g. a microcontroller or microprocessor comprising a respective program with executable instructions. The distance sensor may e.g. be coupled to the processor via an analog-to-digital converter or a digital interface. The program may then comprise the logic to acquire the measured content distance and compare the measured content distance with the threshold distance. The warning signal may e.g. be provided to the user via a sound source, e.g. a beeper that may be connected to a pin of the controller. The warning signal may be provided to the controller of the cooker e.g. via an analog or digital data connection. The warning signal may e.g. be a binary signal that only comprises two states that indicate if the measured content distance is higher or lower than the threshold distance. The warning signal may however also comprise the measured content distance. This allows the controller of the cooker a fine grained power control. The controller may e.g. reduce the power on the respective cooking hob according to the difference between the measured content distance and the threshold distance.

[0015] Further embodiments of the present invention are subject of the further subclaims and of the following description, referring to the drawings.

[0016] In an embodiment, the monitoring device may comprise a mechanical sensor movement device that may carry the distance sensor and may be configured to translationally move the distance sensor parallel to a surface of the cooking hob, wherein the control unit is configured to determine the threshold distance based at least on a minimum measured distance measured during a movement of the distance sensor over the surface of the cooking hob.

[0017] The mechanical sensor movement device may be any kind of device that carries and moves the distance sensor. Such a device may comprise mechanical and electrical components that interact to provide the movement. The control of the movement may e.g. be performed by the control unit. This allows the control unit to synchronize the measurement of the content distance with the positioning of the distance sensor. The mechanical sensor movement device may move the distance sensor in a plane parallel to the cooking surface of the cooker the hobs.

[0018] During a movement of the distance sensor over the cooking hob, the distance sensor will measure three different distances. The largest distance is the distance between the distance sensor and the surface of the cooking hob. The smallest distance is the distance between the upper edge or rim of the cooking vessel and the distance sensor. The third distance will be between the largest distance and the smallest distance and will represent the content distance.

[0019] The distance sensor may e.g. start on one end of its movement range. There the sensor will probably measure the distance to the cooking surface or hob of the cooker. The movement will move the distance sensor of the top edge of the cooking vessel on one side of the cooking vessel. Here the minimum distance will be measured. Further movement will move the distance sensor over the content of the cooking vessel. Here the content distance will be measured. Then the distance sensor will again move over the top edge of the cooking vessel and then the cooking surface of the cooker or hob. Therefore, cooking vessels of any size may be used with the present invention.

[0020] It is understood, that the range of movement of the distance sensor may be larger by a predetermined size than the outer edge or outer dimensions of the respective cooking hob. This will make sure that the distance sensor measures the above mentioned distances even if the cooking vessel is larger than the cooking hob.

[0021] The control unit may then use the minimum distance as a base value for calculating the threshold distance. The aim is that the content distance stays below the minimum distance, which represents the upper edge of the cooking vessel. This will ensure that the content does not leak out of the cooking vessel and does not spill over the surface of the cooker.

[0022] In another embodiment, the mechanical sensor movement device may comprise guide rails and at least one slide and an electric drive for moving the at least one slide, wherein the distance sensor may be arranged on the at least one slide.

[0023] A guide rail and slide system is a mechanically very stable yet simple construction that may be efficiently used to move the distance sensor. The electric drive, e.g. an electric motor, may e.g. drive the slide directly and be mounted on the slide or the guide rail. As alternative, the electric drive may be coupled to the slide via belts or via a threaded spindle.

[0024] In a further embodiment, the monitoring device may comprise a cooker hood, especially an exhaust hood, wherein the mechanical sensor movement device may be arranged in the cooker hood.

[0025] Exhaust hoods, also called e.g. fume extractor hoods, may be provided over the cooker surface to extract fumes that are generated while cooking. Usually such an exhaust hood will be provided directly over the coking surface and is therefore in the ideal position to accommodate the distance sensor.

[0026] In an embodiment, the monitoring device may comprise one dedicated distance sensor for every cooking hob of the cooker.

[0027] The cooker may comprise a plurality of cooking hobs, like e.g. four cooking hobs. It is obvious, that the monitoring device should not only monitor one of the cooking hobs. Therefore, a dedicated distance sensor may be provided for every cooking hob.

[0028] It is understood, that also one mechanical sensor movement device may be provided for every distance sensor. As alternative, it may be possible to provide a mechanical sensor movement device that moves a distance sensor over two or all of the hobs. A purely linear mechanical sensor movement device may e.g. comprise a linear guide rail that spans over two cooking hobs.

[0029] Another possible mechanical sensor movement device may be a circular mechanical sensor movement device. Such a circular mechanical sensor movement device may e.g. comprise a circular guide rail with a slide or a rotating element, e.g. a rod or beam that rotates around the center of the cooker surface in a plane parallel to the cooker surface. The radius of the movement may e.g. be such that the distance sensor moves over the center points of all the single cooking hobs during a full turn.

[0030] In another embodiment, the control unit may be configured to determine the threshold distance as being the sum of the minimum measured distance and a safety margin distance.

[0031] As explained above, the minimum measured distance represents the top edge or rim of the cooking vessel. Therefore, when the measured content distance is equal to the minimum measured distance, the content has already reached the top edge of the cooking vessel and is about to overflow. Therefore, a safety margin distance may be added to the minimum distance to determine the threshold distance. The safety margin distance may comprise a predetermined constant value of e.g. 1 cm to 5 cm, e.g. 1 cm, 2 cm, 3 cm, 4 cm or 5 cm, or 5 cm to 10 cm.

[0032] The control unit may as alternative also be configured to determine the threshold distance as being the sum of the minimum measured distance and a predetermined percentage of the difference between the maximum measured distance and the minimum measured distance. The difference between the maximum measured distance and the minimum measured distance will result in the approximate height of the cooking vessel. A percentage of this height may e.g. be used as the safety margin. The percentage may e.g. be 10%, 20%, 30%, 40% or 50%. Any value between the explicitly mentioned values is also possible.

[0033] In an embodiment, the distance sensor may comprise an ultrasonic-based distance sensor.

[0034] Ultrasonic-based distance sensors, also called ultrasonic distance sensors, emit high frequency sound waves, e.g. in the ultrasonic frequency range that is not perceptible to the human ear. This high frequency sound waves are sent by the ultrasonic distance sensor in the direction of the cooker surface or the cooking vessel. When the ultrasonic sound waves hit the obstacle, i.e. the content of the cooking vessel, the surface of the cooker or the top edge of the cooking vessel, they are reflected back and the sound waves are detected by the distance sensor.

[0035] The time of travel of the sound wave varies depending on the distance between the obstacle and the distance sensor. The velocity of ultrasonic sound waves is known. The distance information may therefore be obtained by multiplying the known speed of the ultrasonic sound waves with half the value (because of the sound waves traveling from the distance sensor to the content and back) of the time of travel of the ultrasonic sound waves. As indicated above, this information may be converted into an analog voltage or a digital value for outputting to the control unit.

[0036] The distance sensor may e.g. comprise an ultrasonic transmitter that emits the ultrasonic sound waves and a receiver that receives the sound waves. A measurement element in the distance sensor may then measure the time of travel of the ultrasonic sound waves.

[0037] In a further embodiment, the distance sensor may comprise an optical distance sensor, especially a camera, especially a stereo camera, or a time of flight sensor.

[0038] The ultrasonic distance sensor mentioned above may certainly work correctly if the cooking vessel is not covered with a lid. If a lid is provided that covers the cooking vessel, the distance sensor may not measure through the lid.

[0039] Especially with glass lids an optical distance sensor may however measure the distance through such a lid. A time of flight sensor may e.g. use laser light to measure the content distance. It is understood, that a time of flight sensor may receive photons that are reflected on the lid and photons that are reflected by the content of the cooking vessel. The time of flight sensor may therefore be configured to register or process only the last incoming photons, which will be the ones reflected from the surface that is farthest away from the detector of the distance sensor, i.e. the content of the cooking vessel.

[0040] A stereo camera may also be used to determine the distance to the content of the cooking vessel through a glass lid on the cooking vessel. The stereo camera may comprise two separate camera or imaging sensors for recording images of the cooking vessel from different perspectives. A triangulation technique may then be used to determine the content distance to the content in the cooking vessel.

[0041] In an embodiment, the control unit may be configured to detect that a cooking vessel is placed under the distance sensor based on the measured content distance and may automatically measure the minimum measured distance after detecting that a cooking vessel is placed under the distance sensor.

[0042] The control unit may e.g. permanently monitor the distance that is currently measured by the distance sensor. If this distance is the maximum distance measured during a movement of the distance sensor, the control unit may assume that no cooking vessel is placed on the respective hob. As soon as the measured distance decreases, the control unit may initiate another measurement moving the distance sensor from one extreme of the mechanical sensor movement device to the other extreme, and therefore scan the respective hob.

[0043] In addition to monitoring if a cooking vessel is placed on the hob, the control unit may also monitor if a cooking vessel is removed after it has been placed on the hob. The control unit may e.g. control the distance sensor to be in the center of the cooking hob after a cooking vessel is placed on the cooking hob. If the measured distance in this position during a measurement is equal to the maximum distance or at least lower than the originally measured content distance (without the content boiling), the control unit may assume that the cooking vessel is removed. The warning signal output may then be deactivated and the above described measurements may be performed, if a new cooking vessel is placed on the cooking hob.

[0044] It is understood, that the monitoring device may also comprise user input elements, like e.g. buttons or the like that may trigger the monitoring device to monitor a cooking vessel.

[0045] After initiating the monitoring of a cooking vessel, as already indicated above, the monitoring device, e.g. the control unit, may repeatedly monitor the content distance in predetermined intervals.

[0046] In another embodiment, the monitoring device may comprise a communication interface configured to couple to the cooker and receive information about active cooking hobs of the cooker.

[0047] The communication interface of the monitoring device may be any type of interface that serves to transmit the information about active cooking hobs of the cooker to the monitoring device. Such an interface may e.g. be a discrete interface that comprises for every hob a binary input. If a positive signal is provided by the cooker at that input, the monitoring device may start monitoring the respective hob. With such an interface the cooker need not necessarily be provided with a digital controller because such signals may also be generated in an analog fashion. The interface may however also comprise a digital, e.g. serial or parallel, interface that communicates the monitoring device with the cooker.

[0048] The monitoring device may then start monitoring a hob, if the respective hob is indicated as active.

BRIEF DESCRIPTION OF THE DRAWINGS

[0049] For a more complete understanding of the present invention and advantages thereof, reference is now made to the following description taken in conjunction with the accompanying drawings. The invention is explained in more detail below using exemplary embodiments, which are specified in the schematic figures of the drawings, in which:

Fig. 1 shows a block diagram of an embodiment of a cooker according to the present invention;

Fig. 2 shows a block diagram of an embodiment of a monitoring device according to the present invention;

Fig. 3 shows a block diagram of another embodiment of a monitoring device according to the present invention; and

Fig. 4 shows a flow diagram of an embodiment of a monitoring method according to the present invention.

[0050] In the figures like reference signs denote like elements unless stated otherwise.

DETAILED DESCRIPTION OF THE DRAWINGS

[0051] Fig. 1 shows a block diagram of an embodiment of a cooker 100. The cooker 100 comprises a controller 101 that controls four cooking hobs 102, 103, 104, 105. The cooker 100 further comprises a monitoring device 106. The monitoring device 106 comprises a distance sensor 107. The distance sensor 107 is coupled to a control unit 109 and provides a measured distance 108 to the control unit 109.

[0052] The cooking hobs 102, 103, 104, 105 may be used to heat up content of a cooking vessel that is placed on a respective one of the cooking hobs 102, 103, 104, 105. The controller 101 may control the output power or heat level that is generated by the cooking hobs 102, 103, 104, 105. If liquid in a cooking vessel starts boiling, the level of liquid in the vessel may rise.

[0053] With the help of the monitoring device 106 the rising of the liquid level may be detected and a warning signal 111 may be output by the control unit 109. To this end, the control unit 109 after receiving a measured distance 108 from the distance sensor 107 may compare the measured distance 108 to a threshold distance 110.

[0054] The threshold distance 110 may e.g. be predetermined. However, to provide more flexibility and the ability to adapt the monitoring device 106 to different cooking vessels, the threshold distance 110 may be configurable or the control unit 109 may automatically determine the threshold distance 110. A user may e.g. indicate that a cooking vessel

is placed under the distance sensor 107. The control unit 109 may then determine the distance 108 to the content of the cooking vessel. The control unit 109 may determine the threshold distance 110 based on this measured distance. The control unit 109 may e.g. add a specific amount, e.g. 1 cm, 2 cm, 3 cm, 4 cm or the like to the measured distance 108 to determine the threshold distance 110. Another scheme for determining the threshold distance 110 will be presented and explained with regard to Fig. 3.

[0055] The distance sensor 107 of the monitoring device 106 may e.g. be an ultrasonic-based distance sensor 107. As explained above, ultrasonic distance sensors measure a distance by measuring the time of travel of emitted ultrasonic sound waves. As an alternative, the distance sensor 107 may be an optical distance sensor 107 like e.g. a stereo camera or a time of flight sensor.

[0056] Further, although only one distance sensor 107 is shown, it is understood, that one dedicated distance sensor 107 may be provided for every cooking hob 102, 103, 104, 105 of the cooker 100.

[0057] The monitoring device 106 further comprises an optional communication interface 112. The communication interface 112 may be used to communicate data from the cooker 100, i.e. the controller 101, to the monitoring device 106, i.e. the control unit 109. The data may e.g. comprise information about active cooking hobs 102, 103, 104, 105 of the cooker 100. The data may also comprise the warning signal 111 that may be communicated to the controller 101. The controller 101 may then e.g. lower the output power of the respective cooking hob 102, 103, 104, 105.

[0058] Fig. 2 shows a block diagram of a monitoring device 206. The monitoring device 206 is shown without any cooker. This is to emphasize that the monitoring device 206 may also be provided as separate device that need not necessarily be an integral part of a cooker. Instead the monitoring device 206 may e.g. be integrated into a cooker or exhaust hood that may be provided e.g. in a kitchen.

[0059] The monitoring device 206 comprises four distance sensors 207, 215, 216, 217 that are coupled to a control unit 209. The control unit 209 may compare the measured distances to the threshold distance 210. In addition, the monitoring device 206 comprises a user input 218 that is coupled to the control unit 209.

[0060] In the monitoring device 206 every one of the distance sensors 207, 215, 216, 217 is configured to monitor one of the hobs of a cooker that is provided under the monitoring device 206. Therefore, every one of the distance sensors 207, 215, 216, 217 separately provides measurement values to the control unit 209. The control unit 209 may then separately monitor the single hobs and provide separate warning signals 211 for the different hobs. For example different audible signals may be provided as warning signals 211 that identify the respective hob. The position of the respective hob may e.g. be provided to a user as voice output. As an alternative or in addition, the warning signal 211 may e.g. be provided as a combined audible and visible signal. An audible beeping signal could e.g. alert a user and a visual indication could e.g. indicate the respective hob. For example a single signal, e.g. a light, may be provided for every hob.

[0061] The user input 218 may be used by a user to control the monitoring device 206. The user may e.g. activate the monitoring device 206 via the user input 218. The user may also initiate the monitoring device 206 such that the control unit 209 measures a distance and stores this distance as the distance to the content of the cooking vessel without the content boiling. This stored distance may then be used as a basis for monitoring overflow.

[0062] Fig. 3 shows a block diagram of another monitoring device, especially the distance sensor 307 and a mechanical sensor movement device 320 that carries the distance sensor 307.

[0063] The mechanical sensor movement device 320 comprises a guide rail 321. A slide 322 is arranged on the guide rail 321 and carries the distance sensor 307. It is understood, that any type of drive, e.g. an electric motor with a belt or a threaded spindle may be used to drive the slide 322, although it is not separately shown.

[0064] With the mechanical sensor movement device 320 the distance sensor 307 may be moved on a linear trajectory e.g. in a plane parallel to the cooker surface 329. The mechanical sensor movement device 320 is positioned such that the distance sensor 307 may move over at least one hob of the cooker surface 329. It is understood, that the mechanical sensor movement device 320 may also be long enough to allow movement of the distance sensor 307 over two or more adjacent hobs of the cooker surface 329.

[0065] In Fig. 3 an exemplary cooking vessel 328 is placed on the cooker surface 329. For monitoring the content 330 of the cooking vessel 328, the monitoring device may determine three distances on the way from one end point to the other end point of the guide rail 321.

[0066] The first distance is the maximum measured distance 325. This distance is the distance from the distance sensor 307 to the cooker surface 329. The second distance may be the minimum measured distance 326, i.e. the distance between the distance sensor 307 and the top edge of the cooking vessel 328. The third distance will then be the content distance 327, i.e. the distance between the distance sensor 307 and the content 330 in the cooking vessel 328.

[0067] The control unit of the monitoring device may then e.g. calculate the threshold distance based on the minimum measured distance 326 or on a relationship of the maximum measured distance 325 to the minimum measured distance 326. The difference of these values is the approximate height of the cooking vessel 328. The difference of the minimum measured distance 326 and the content distance 327 is the margin that is available for the boiling content 330 until it overflows.

[0068] For sake of clarity in the following description of the method based Fig. 4 the reference signs used above in the description of apparatus based Figs. 1 - 3 will be maintained.

[0069] Fig. 4 shows a flow diagram of an embodiment of a monitoring method for monitoring liquid overflow in a cooking vessel 328 on a cooking hob 102, 103, 104, 105 of a cooker 100.

[0070] The monitoring method comprises measuring S1 a content distance 327 between a distance sensor 107, 207, 215, 216, 217, 307 and a content of the cooking vessel 328 with an ultrasonic distance sensor 107, 207, 215, 216, 217, 307 or with an optical distance sensor 107, 207, 215, 216, 217, 307. The monitoring method also comprises comparing S2 the measured content distance 327 to a threshold distance 110, 210, and outputting S3 a warning signal 111, 211 if the measured content distance 327 is smaller than the threshold distance 110, 210.

[0071] The monitoring method may comprise translationally moving the distance sensor 107, 207, 215, 216, 217, 307 parallel to a surface of the cooking hob 102, 103, 104, 105, and determining the threshold distance 110, 210 based at least on a minimum measured distance 326 measured during a movement of the distance sensor 107, 207, 215, 216, 217, 307 over the surface of the cooking hob 102, 103, 104, 105. The threshold distance 110, 210 may e.g. be determined as the sum of the minimum measured distance 326 and a safety margin distance.

[0072] The monitoring method may also comprise detecting that a cooking vessel 328 is placed under the distance sensor 107, 207, 215, 216, 217, 307 based on the measured content distance 327. The minimum measured distance 326 may then automatically be measured after detecting that a cooking vessel 328 is placed under the distance sensor 107, 207, 215, 216, 217, 307 again.

[0073] Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that a variety of alternate and/or equivalent implementations exist. It should be appreciated that the exemplary embodiment or exemplary embodiments are only examples, and are not intended to limit the scope, applicability, or configuration in any way. Rather, the foregoing summary and detailed description will provide those skilled in the art with a convenient road map for implementing at least one exemplary embodiment, it being understood that various changes may be made in the function and arrangement of elements described in an exemplary embodiment without departing from the scope as set forth in the appended claims and their legal equivalents. Generally, this application is intended to cover any adaptations or variations of the specific embodiments discussed herein.

[0074] Thus, the present invention provides a monitoring device 106, 206 for monitoring liquid overflow in a cooking vessel 328 on a cooking hob 102, 103, 104, 105 of a cooker 100, the monitoring device 106, 206 comprising a distance sensor 107, 207, 215, 216, 217, 307 that is arranged over the cooking hob 102, 103, 104, 105 and that is configured to measure a content distance 327 between the distance sensor 107, 207, 215, 216, 217, 307 and a content of the cooking vessel 328, and a control unit 109, 209 that is coupled to the distance sensor 107, 207, 215, 216, 217, 307 and that is configured to compare the measured content distance 327 to a threshold distance 110, 210 and to output a warning signal 111, 211 if the measured content distance 327 is smaller than the threshold distance 110, 210. Further, the present invention provides a cooker 100 and a respective monitoring method.

List of reference signs

[0075]

100	cooker
101	controller
102, 103, 104, 105	cooking hob
106, 206	monitoring device
107, 207, 215, 216, 217, 307	distance sensor
108	distance
109, 209	control unit
110, 210	threshold distance
111, 211	warning signal
112	communication interface
218	user input
320	mechanical sensor movement device
321	guide rail
322	slide
325	maximum measured distance
326	minimum measured distance

327 content distance

328 cooking vessel
329 cooker surface
330 content

S1, S2, S3 method steps

Claims

1. Monitoring device (106, 206) for monitoring liquid overflow in a cooking vessel (328) on a cooking hob (102, 103, 104, 105) of a cooker (100), the monitoring device (106, 206) comprising:

   a distance sensor (107, 207, 215, 216, 217, 307) that is arranged over the cooking hob (102, 103, 104, 105) and that is configured to measure a content distance (327) between the distance sensor (107, 207, 215, 216, 217, 307) and a content of the cooking vessel (328), and
   a control unit (109, 209) that is coupled to the distance sensor (107, 207, 215, 216, 217, 307) and that is configured to compare the measured content distance (327) to a threshold distance (110, 210) and to output a warning signal (111, 211) if the measured content distance (327) is smaller than the threshold distance (110, 210).

2. Monitoring device (106, 206) according to claim 1, comprising a mechanical sensor movement device (320) that carries the distance sensor (107, 207, 215, 216, 217, 307) and is configured to translationally move the distance sensor (107, 207, 215, 216, 217, 307) parallel to a surface of the cooking hob (102, 103, 104, 105),
   wherein the control unit (109, 209) is configured to determine the threshold distance (110, 210) based at least on a minimum measured distance (326) measured during a movement of the distance sensor (107, 207, 215, 216, 217, 307) over the surface of the cooking hob (102, 103, 104, 105).

3. Monitoring device (106, 206) according to claim 2, wherein the mechanical sensor movement device (320) comprises guide rails (321) and at least one slide (322) and an electric drive for moving the at least one slide (322), wherein the distance sensor (107, 207, 215, 216, 217, 307) is arranged on the at least one slide (322).

4. Monitoring device (106, 206) according to claim 3, comprising a cooker hood, especially an exhaust hood, wherein the mechanical sensor movement device (320) is arranged in the cooker hood.

5. Monitoring device (106, 206) according to any one of the preceding claims, comprising one dedicated distance sensor (107, 207, 215, 216, 217, 307) for every cooking hob (102, 103, 104, 105) of the cooker (100).

6. Monitoring device (106, 206) according to any one of the preceding claims 2 to 5, wherein the control unit (109, 209) is configured to determine the threshold distance (110, 210) as being the sum of the minimum measured distance (326) and a safety margin distance.

7. Monitoring device (106, 206) according to any one of the preceding claims, wherein the distance sensor (107, 207, 215, 216, 217, 307) comprises an ultrasonic-based distance sensor (107, 207, 215, 216, 217, 307).

8. Monitoring device (106, 206) according to any one of the preceding claims 1 to 6, wherein the distance sensor (107, 207, 215, 216, 217, 307) comprises an optical distance sensor (107, 207, 215, 216, 217, 307), especially a camera, especially a stereo camera, or a time of flight sensor.

9. Monitoring device (106, 206) according to any one of the preceding claims 2 to 8, wherein the control unit (109, 209) is configured to detect that a cooking vessel (328) is placed under the distance sensor (107, 207, 215, 216, 217, 307) based on the measured content distance (327) and to automatically measure the minimum measured distance (326) after detecting that a cooking vessel (328) is placed under the distance sensor (107, 207, 215, 216, 217, 307).

10. Monitoring device (106, 206) according to any one of the preceding claims, comprising a communication interface (112) configured to couple to the cooker (100) and receive information about active cooking hobs (102, 103, 104, 105) of the cooker (100).

11. Cooker (100) for cooking content in cooking vessels (328), the cooker (100) comprising:

a number of cooking hobs (102, 103, 104, 105) for accommodating the cooking vessels (328),
a monitoring device (106, 206) according to any one of the preceding claims.

12. Cooker (100) according to claim 11, comprising a controller (101) configured to control the output power of the cooking hobs (102, 103, 104, 105) and provide an information about active ones of the cooking hobs (102, 103, 104, 105) to the monitoring device (106, 206).

13. Monitoring method for monitoring liquid overflow in a cooking vessel (328) on a cooking hob (102, 103, 104, 105) of a cooker (100), the monitoring method comprising:

measuring (S1) a content distance (327) between a distance sensor (107, 207, 215, 216, 217, 307) and a content of the cooking vessel (328) with an ultrasonic distance sensor (107, 207, 215, 216, 217, 307) or with an optical distance sensor (107, 207, 215, 216, 217, 307),
comparing (S2) the measured content distance (327) to a threshold distance (110, 210), and
outputting (S3) a warning signal (111, 211) if the measured content distance (327) is smaller than the threshold distance (110, 210).

14. Monitoring method according to claim 13, comprising translationally moving the distance sensor (107, 207, 215, 216, 217, 307) parallel to a surface of the cooking hob (102, 103, 104, 105), and determining the threshold distance (110, 210) based at least on a minimum measured distance (326) measured during a movement of the distance sensor (107, 207, 215, 216, 217, 307) over the surface of the cooking hob (102, 103, 104, 105).

15. Monitoring method according to any one of claims 13 and 14, wherein the threshold distance (110, 210) is determined as the sum of the minimum measured distance (326) and a safety margin distance; and/or
wherein it is detected that a cooking vessel (328) is placed under the distance sensor (107, 207, 215, 216, 217, 307) based on the measured content distance (327) and the minimum measured distance (326) is automatically measured after detecting that a cooking vessel (328) is placed under the distance sensor (107, 207, 215, 216, 217, 307).

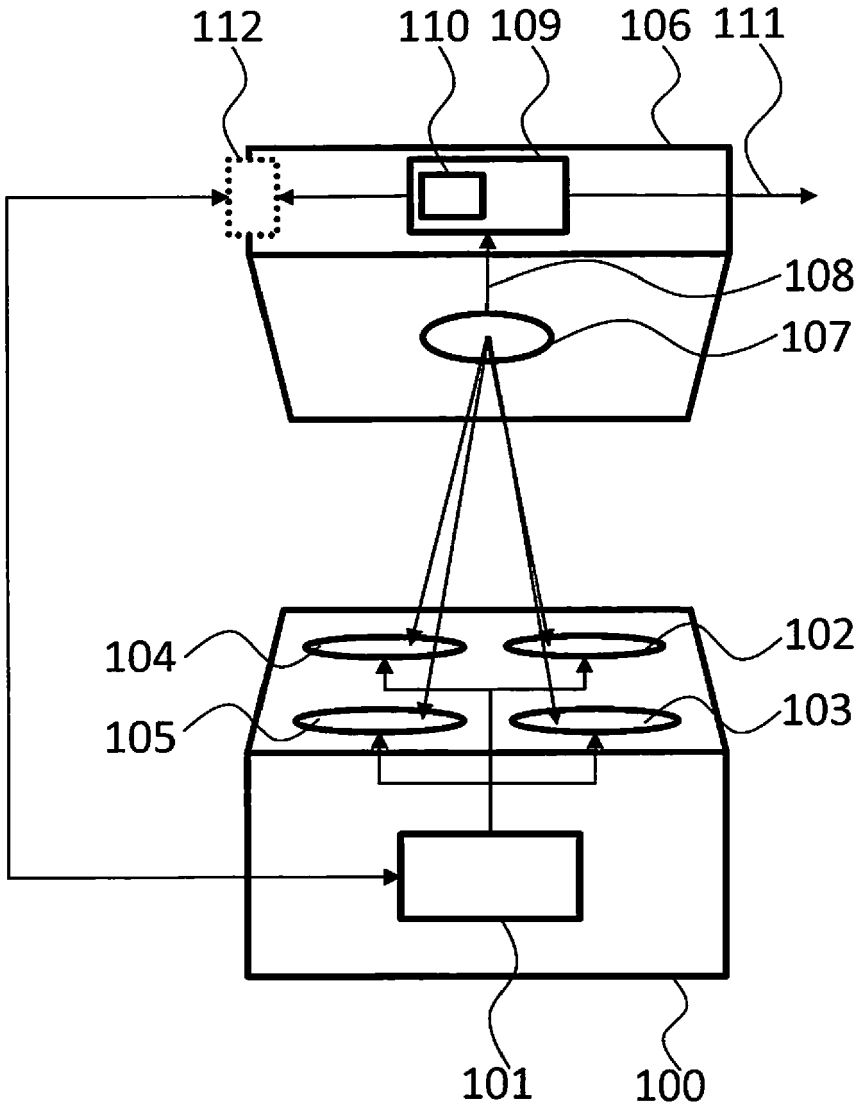

Fig. 1

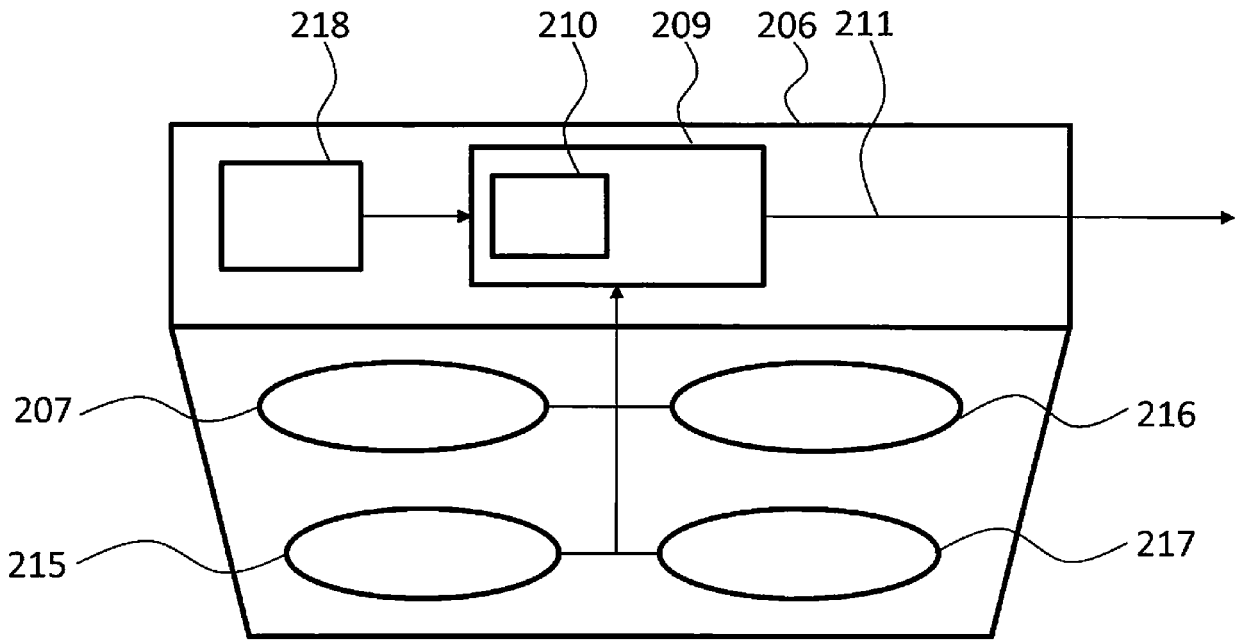

Fig. 2

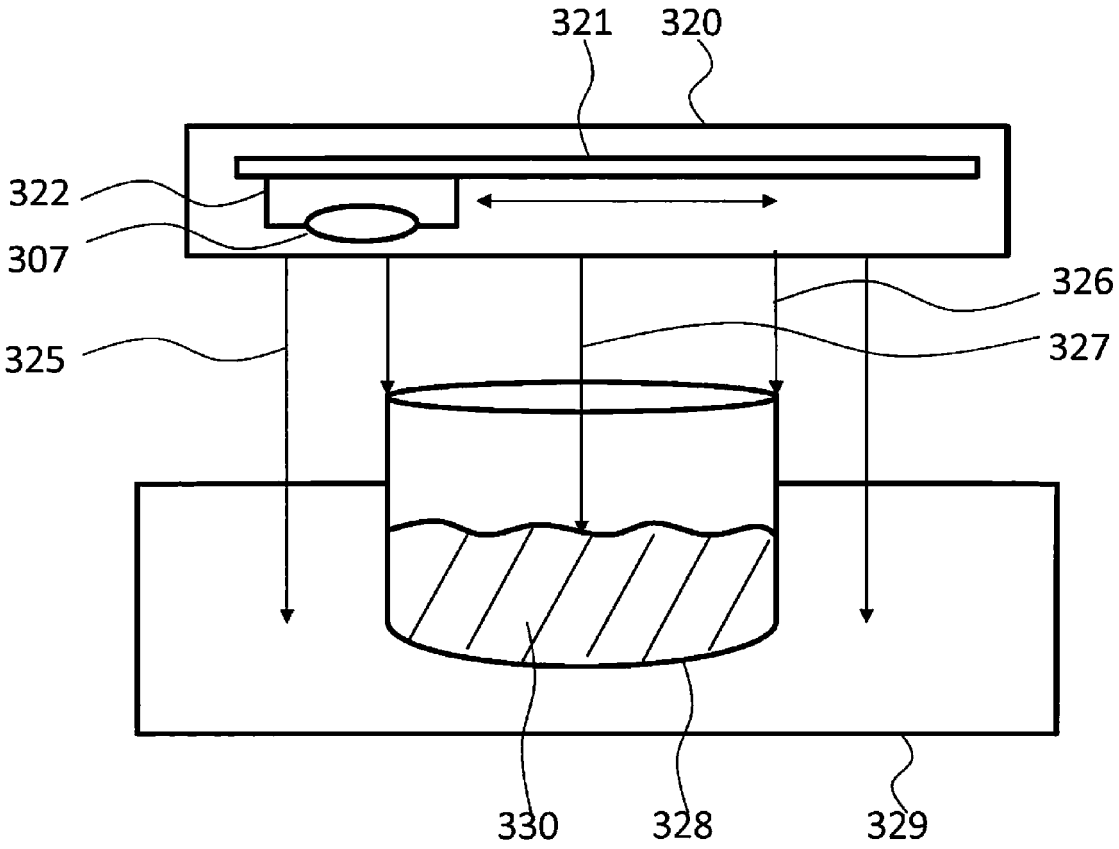

Fig. 3

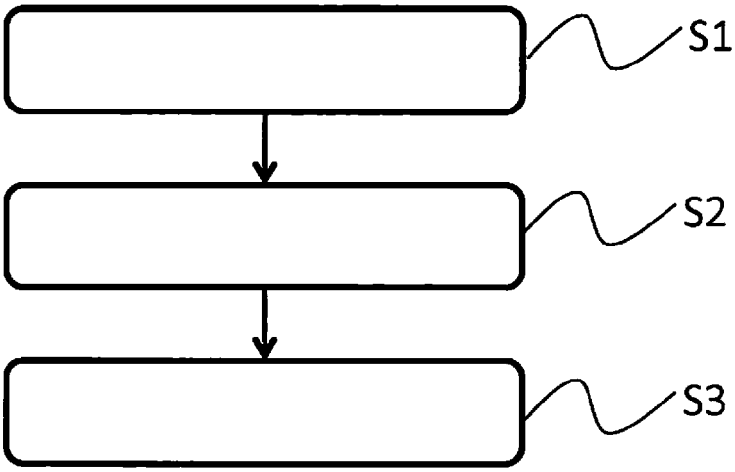

Fig. 4

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EUROPEAN SEARCH REPORT

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EP 17 18 2622

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 January 2018	Harder, Sebastian

CATEGORY OF CITED DOCUMENTS

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